REMARKS/ARGUMENTS

Prior to this Amendment, claims 18-29, 32, 33, 35-37, 50-61, and 63-65 were pending in the Application. In the final Office Action mailed April 10, 2008, the Examiner withdrew all anticipation rejections of the pending claims, and the claims now stand rejected as being obvious in light of combined teachings of newly-cited references.

Dependent claims 53 and 54 are cancelled to address a drawing objection by the Examiner and to hasten allowance of the application.

Independent claim 50 is amended to delete language that was objected to by the Examiner as being unsupported by the specification. Since this amendment only clarifies the claim and does not add new limitations or issues for review, Applicants request that the claim amendment be entered as it places the claim in better condition for allowance or use on appeal.

Similarly, independent claim 57 is amended to clarify previously presented claim limitations. No new issues are raised by these claim amendments, and entry of the amendment to claim 57 is requested to place the claim in condition for allowance or use on appeal.

Independent claim 18 is amended to include the limitation of dependent claim 27, which is cancelled. Since claim 27 has been fully examined/considered by the Examiner, this amendment does not raise new issues or place an additional burden on the Examiner. Hence, entry of this amendment is requested to place the claim in condition for allowance or use on appeal. Dependent claim 28 is amended to correct claim dependency.

After entry of the Amendment, claims 18-26, 28, 29, 32, 33, 35-37, 50-52, 55-61, and 63-65 remain for consideration.

Drawing Objections

The April 10, 2008 Office Action objected to the drawings for failing to show the features called for in dependent claims 53 and 54. Instead of amending the drawings at this time, claims 53 and 54 are cancelled to address these objections and hasten allowance of the remaining claims. However, it is noted that full support for these claim limitations is provided in the text of the specification, and Applicants assert that

inclusion of drawings specifically showing these structural features is not required by the patent statutes, which call for figures as necessary for one skilled in the art to understand the claimed invention when the figures are considered in light of the specification (e.g., see 35 U.S.C. §113 which states a patent application should include "a drawing where necessary for the understanding of the subject matter sought to be patented").

Claim Rejections under 35 U.S.C. §112, First Paragraph

The final Office Action rejected claims 50-61 and 63-65 under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Regarding independent claim 50, the Examiner indicates that the limitation "a majority of the tabs are arranged with a leading edge proximate to the leading edge of the fin body and substantially parallel to local flow paths in an air flow passage adjacent the fin body" is not supported by the specification/figures. The Examiner construed the meaning of this limitation to mean that a majority of the tabs are located proximate to the leading edge of the fin body rather than a majority of the leading edges of the tabs are proximate to the leading edge of the fin body as intended by the Applicants. However, Applicants have deleted the language at issue from claim 50 to clarify the claim language and address the rejection of claim 50 and claims 51-56, which depend from claim 50.

Regarding independent claim 57, the Examiner asserts that there is no support for the limitation of "wherein due to the forming of the openings the fin body has a surface porosity of less than about 30 percent and has areas of higher porosity provided by the tab pattern proximate to predefined areas of high flow of a cooling gas across the fin body during operation of the heat exchanger." The Examiner argues that the specification discussion on page 8, lines 2-6, that the porosity may be less than 50 percent and typically between 15 and 30 percent does not adequately support the claim language. Applicants disagree, but, to hasten allowance, claim 57 is amended to call for the porosity to be between about 10 and 40 percent with support found at least in para. [0039]. Support for the second or latter portion of this claim limitation is found at least in para. [0048]; hence, further claim amendments are required to address this

claim rejection (and the rejection of claims 58-61 and 63-65, which depend from claim 57.

Claim Rejections under 35 U.S.C. §112, Second Paragraph

The final Office Action rejected claims 57-61 and 63-65 under 35 U.S.C. §112, second paragraph, as failing to comply with the written description requirement. The Examiner asserts that the language of independent claim 57 is indefinite because the limitation of "wherein due to the forming of the openings the fin body has a surface porosity of less than about 30 percent and has areas of higher porosity provided by the tab pattern proximate to predefined areas of high flow of a cooling gas across the fin body during operation of the heat exchanger" may be construed to claim a porosity of greater than 30 percent and higher than 30 percent. Applicants have amended claim 57 so as to call for the surface porosity of the fin body in the range of about 10 to about 40 percent. The second portion of the limitation calls for "areas of higher porosity" to be provided by the tab pattern "proximate to predefined areas of high flow of a cooling gas." When construed in light of the specification such as para. [0048], this language is not indefinite as it clearly calls for overall porosity of the surface to be 10 to 40 percent with areas of higher porosity in the surface to be in high flow areas for the gas (such as upstream of tubes). Since one skilled in the art would readily understand this claim language, further amendments/changes to the claim language is not required to clarify the invention claimed in claim 57.

The April 10, 2008 Office Action did not present any rejection of claims 57-61 and 63-65 based on anticipation or obviousness. Hence, once the amendment to claim 57 is entered to address the indefiniteness rejection, claim 57 and claims 58-61 and 63-65, which depend on claim 57, are believed to be in condition for allowance.

Claim Rejections under 35 U.S.C. §103

The Office Action rejected claims 18-20, 23-26, 32, 33, 35, and 50-55 under 35 U.S.C. §103(a) as being unpatentable over U.S. Pat. No. 4,997,036 ("Schulze") in view of U.S. Pat. No. 6,349,761 ("Liu"). This rejection is respectfully traversed based on the following remarks.

As described in Applicants' specification toward the end of para. [0008], prior finned-tube heat exchangers had attempted to increase heat transfer coefficients by disrupting boundary layer development. In some of these structures, winglets or vortex generators were provided on the surface area of a fin body with a large profile or surface area placed into the gas flow path. In other words, these winglets were placed transverse or even orthogonal to the gas flow path so as to disrupt and direct flow. But, these devices with larger forms/profiles had large pressure drops in the cooling gas "which is generally an undesirable and often unacceptable result." Likewise, Schulze teaches the addition of "turbulators" or "vortex or turbulence generators" (see, col. 1, lines 9 and 10). The turbulators or vortex generators are shown as element 3 in Figures 1-3, and in col. 2 are described as being positioned at an angle of 10 to 30 degrees relative to a tube longitudinal plane (RLE in the figures). Hence, Schulze teaches placing a large surface area or profile within the flow path to disrupt or flow (see vortices 5 behind each turbulator 3 in the figures), and this undesirably creates a large pressure drop.

In contrast, Applicants teach use of tabs on heat transfer surfaces that are substantially parallel to flow paths so as to provide a desirable increase in heat transfer by increasing surface area in the gas flow while limiting or controlling the increase in pressure drop. Specifically, claim 18 calls for a metallic fin body with first and second heat transfer surfaces. A plurality of tabs is provided that extends from "the first and second heat transfer surfaces" at offset angles as measured from a simple flow path of "less than 10 degrees." Schulze teaches away from the use of such a small offset angle for the tabs in part because Schulze teaches creation of a vortex 5 at each turbulator 3. To this end, Schulze teaches in col. 2 that the preferred embodiment uses an offset angle of 15 degrees. Hence, Schulze fails to teach the use of tabs at offset of less than 10 degrees and actually teaches that the offsets need to be greater than this claimed amount. Liu is only cited for teaching use of a tube collar for mounting and fails to overcome this deficiency of Schulze. For at least this reason, the combined teaching of Schulze and Liu fails to teach or suggest the tabs of claim 18.

Further, claim 18 calls for the tabs to extend "from the first and second heat transfer surfaces." The Office Action, at the top of page 5, cites Schulze for teaching

this limitation with its turbulators 3. However, with reference to Figures 1-4 of Schulze, it can be seen that Schulze teaches two heat transfer surfaces, but it only shows the turbulators 3 extending from a single surface on each fin 2. Liu fails to overcome this deficiency of Schulze. Hence, claim 18 is allowable over Schulze and Liu for this additional reason.

Claims 19, 20, 23-26, 32, 33, and 35 depend from claim 18 and are allowable over Schulze and Liu for at least the reasons provided for allowing claim 18. Further, claim 20 calls for about 50 percent of the tabs to extend from the first surface. Schulze is cited as showing this with its turbulators 3, but Schulze teaches 100 percent from a first surface and not 50 percent from one side and 50 percent from the other. Claim 23 calls for the tabs to be less densely distributed in a wake region near the tube collars. The only distribution shown by Schulze is of substantially equal distribution. Hence, it fails to teach providing less tabs (or any tabs for that matter due to the size of the tube) in the wake region downstream from a tube.

Claim 24 calls not only for the tabs to extend from both surfaces of the fin body (which is not shown by Schulze) but to extend in rows with some of the tabs in each row extending from an opposite side/surface. Schulze fails to show such a design with its turbulators 3, which extend from the same side in each "row." Claim 32 calls for a minority of the tabs to be at an angle relative to the majority (the minority located near tube collar to direct flow into the wake area/around the tube collar). Schulze is cited for teaching this limitation, but Applicants disagree as Schulze teaches half of the turbulators 3 are at a first offset angle and half of the turbulators 3 at a second offset angle in Figure 2, with the angle being equal in magnitude and opposite in sign. In other words, a minority is not shown to be at an angle relative to a majority – let alone the minority being proximate to the tube collar for directing flow in a particular manner. Liu fails to overcome these deficiencies of Schulze. For these additional reasons, these dependent claims are believed allowable over these two references.

With regard to independent claim 50, The tabs "are arranged substantially parallel to local flow paths in an air flow passage adjacent the fin body." Such an arrangement may be seen in Applicants' Figure 14. As can be seen, the tabs typically are parallel to the local flow paths and differing offset angles are provided in the tab

pattern. The Office Action appears to be generally citing Schulze, but no citation is provided for Schulze teaching arranging its turbulators 3 to be parallel to local flow. Applicants assert that Schulze teaches away from placing its turbulators parallel to local flow in Figure 2 and elsewhere as it shows a vortex 5 being formed for each turbulator 3, which would generally not occur if the tabs were parallel to flow. Schulze does not discuss or mention local flow but instead places all of the turbulators at like angles (e.g., not taking into account local flows). Since Schulze teaches placing its turbulators 3 transverse to flow, it fails to teach the device of claim 50 and actually teaches away from the parallel tab limitation. Liu fails to overcome this deficiency of Schulze, and claim 50 is allowable over the combination of these two references.

Claims 51, 52, and 55 depend from claim 50 and are believed allowable over Schulze and Liu for at least the reasons provided for allowing claim 50 over these references.

The April 10, 2008 Office Action also rejected claims 18-29, 32, 33, 35, 50-52, and 54-56 under 35 U.S.C. §103(a) as being unpatentable over U.S. Pat. No. 5,697,432 ("Yun") in view of U.S. Pat. No. 3,438,433 ("Gunter"). This rejection is respectfully traversed based on the following remarks.

In Applicants' prior Amendment, Yun was distinguished from the pending claims and the remarks presented in that Amendment are still believed applicable.

Specifically, as noted in paragraphs [0008] and [0009] of Applicants' specification, prior art finned-tube heat exchangers had attempted to enhance heat transfer by disrupting the boundary layers in the air flow as well as providing increased heat transfer area. This was done by "slitting the fin three or four times in the areas of the fin between the tubes" and by use of winglets and vortex generators. These devices typically created unacceptably large pressure drops as too much surface area faced into the flowing air (e.g., presented a large profile relative to the gas flow path within the fin channel) and/or were not adopted due to increased maintenance costs (e.g., the structures would snag or collect debris) or due to high manufacturing costs. The claimed fins address these issues by providing tabs that have configurations that lend themselves to easy manufacture, that limit maintenance issues, and that significantly increase heat transfer coefficients for fins without unacceptable pressure

drops (e.g., paragraph [0069] discusses test results showing a 70 percent increase in heat transfer coefficient for a tabbed fin with a likely acceptable pressure drop increase of 50 percent).

To this end, claim 18 is directed toward a fin for use with tubes in a finned-tube, air-cooled heat exchanger. In addition to a fin body, a plurality of tabs is provided that extend at a bend angle from the two heat transfer surfaces of the fin body. Each of "the tabs comprises a substantially planar body with a first end attached to the fin body and a second end distal and unattached to the fin body." Such fins, that can readily be made by punching or other techniques, can be seen in Figures 6, 7, and 10, for example. The Office Action cites Yun in Figures 2 and 4-10 as showing tabs with its element 11. However, Yun fails to teach the tabs as called for in claim 18 because elements 11 are slits with a much different construction than required by Applicants' claim language. The Office Action seems to indicate that one could consider a "side" of the slit body as a tab, but Applicants disagree as the entire slit body will effect flow and create a much different heat transfer environment and much larger pressure drop than a planar tab.

More particularly, claim 18 requires that the tabs have "a substantially planar body." Yun teaches a fin 10 with a number of slits 11. The slits are shown in Figures 6 and 7 (and elsewhere) as being formed with two sidewalls 11a, 11b (with the "a" missing in Figure 6) extending from the surface of fin 10 to a slit body (called a "central portion of slits 11" at line 34 of col. 5) that extends parallel to the surface of fin 10 between the two sidewalls 11a, 11b. As will be appreciated, the slits 11 would produce different flow than the tabs of claim 18, and the fin 10 would have a different heat transfer coefficient than the fin of claim 18 due to their differing porosity pattern (e.g., the slit body removes a significant amount of the fin 10 with heat transfer only through the sidewalls 11a, 11b to fin 10). Returning to the language of claim 18, the slits 11 are not planar. The slits 11 have three sides (e.g., two sidewalls and a slit body or central portion) and may be thought of as "U" or "C" shaped. Hence, the slits do not read on the substantially planar limitation of claim 18. Further, each of the tabs of claim 18 is attached at a first end to the fin body but includes a second end that is unattached to the body. In contrast, the slits 11 are attached via sidewalls 11a, 11b at both ends. For

this additional reason, the tab limitations of claim 18 not anticipated by the slits 11 of Yun and fins including such tabs are believed allowable over this reference.

Claim 18 also calls for the tab bodies to be positioned at offset angles, and "substantially all of the tabs" have offset angles that are "less than 10 degrees as measured from a simple flow path." Yun fails to teach that its slits 11 are so arranged, which would create a different flow over the fin 10. The Office Action cites Yun's teaching of "angles (theta 1)" as being less than 10 degrees as teaching this limitation. However, Yun teaches that a significant portion of the slit sidewalls are provided at an angle (theta 2) that is between 30 and 42 degrees. At the top of col. 3, the use of sidewalls at the theta 2 angle is provided to "increase the velocity of air flow passing near the periphery of heat transfer tube 20" to avoid stagnation. This would result in an increased pressure drop relative to a tab at an angle of less than 10 degrees. Applicants' claimed fin, in contrast, provides tabs that are generally parallel to the simple flow path of air across the fin to provide an increase heat transfer area while providing a much lower pressure drop. The lower pressure drop is achieved in this case as a smaller profile is presented in the flow channel, and the profile is smaller since there is no slit body or central portion. It should also be noted that the slit bodies are not provided at an offset angle but are instead provided parallel to the fin body surface. For these additional reasons, the fin of claim 18 is not shown or suggested by Yun.

Gunter is cited for also showing a planar tab, but, as with Yun, Gunter is directed to providing slits 16A on its fin body surface. Claim 18 specifically calls for the tabs to have a planar body "with a first end attached to the fin body and a second end distal and unattached to the fin body." Yun and Gunter both fail to teach such a tab with an unattached second end, but each instead teaches away from such a tab by specifically showing each end of the slit body being attached to the fin body. Gunter fails to overcome the deficiencies of Yun, and the combined teaching of the two references fails to shown the fin of claim 18.

Claims 19-29, 32, 33, and 35 depend from claim 18 and are believed allowable over Yun and Gunter at least for the reasons provided for allowing claim 18 over Yun and Gunter. Further, claim 22 calls for the tab bodies to be generally square or

rectangular with "at least a partially curved shoulder at a leading edge." The Office Action appears to cite Gunter for showing curved shoulders but Gunter fails to show a body with exposed corners/shoulder but instead a continuous edge on the slit body (see slit 16A). No suggestion that the sidewalls of the slits 16A have curved shoulders, and Applicants request the rejection be withdrawn or an explanation of how Gunter teaches this claim limitation be provided. Claim 23 calls for the tabs to be less densely distributed "distal to the leading edge of the fin body", and, in contrast, Yun in Figure 6 shows more slits distal to the leading edge (or left side) of fin 10. For these additional reasons, claims 22 and 23 are not anticipated by Yun.

Claim 24 calls for adjacent ones of the tabs in each of the rows to extend from differing or opposite sides of the fin body. If Yun is said to teach the tabs of claim 18 with its slits, then Figure 6 shows that the slits in each row extend the same direction from the fin 10. However, if the sidewalls are said to teach the tabs of claim 18 (which Applicants do not accept), then the sidewalls of each slit extend in the same direction and do not show adjacent sidewalls in the same row each extending differing directions from the body of fin 10. Dependent claim 26 calls for the adjacent rows of tabs to be offset relative to each other such that the tabs are not coplanar. Yun fails to teach this limitation as it shows in Figure 8 that the inner sidewalls of slits 11 in sequential rows of slits 11 are coplanar. Claim 28 calls for the offset angles to differ for some of the tabs and to be selected such that the tab bodies are "substantially parallel with a plurality of predetermined local flow paths" across the fin or in the fin channel. The Office Action implies that angles theta 1 and 2 teach this limitation, but Applicants disagree as theta 2 is selected to be much greater than 20 degrees (as called for by Applicants) because it is intended that these sidewalls will change and disrupt flow (e.g., to direct flow at a faster rate to the wake region behind the tube) and not to minimize pressure drop by presenting less profile with each tab. For these additional reasons, claims 24, 26, and 28 are not shown or suggested by Yun, and Applicants request that these claims be found allowable over this reference.

Independent claim 50 is directed to a fin for use in a heat exchanger and the fin includes tabs extending outward from each side of the fin body. As with claim 18, the fins are attached to the fin body only at one end, and, hence, the reasons provided for

allowing claim 18 relative to the slits 11 having a central portion and being attached at both ends via sidewalls 11a, 11b are equally applicable to claim 50. Further, claim 50 calls for "a majority of the tabs" to be arranged such that they are "substantially parallel to local flow paths." Yun fails to teach that a majority of its sidewalls 11a, 11b are substantially parallel to local flow paths. The Office Action appears to indicate that the angles theta 1 and 2 were selected to match "a plurality of predetermined local flow paths for a fluid flowing." Applicants disagree. Sidewalls arranged at theta 2 are at a relatively large angle (30 to 42 degrees) with this angle selected to change the velocity of air and direct it toward wake areas behind tubes (see, for example, the top of col. 3). Further, the slits are selected to be relatively large in size (e.g., removed material from the fin body) and provided on opposite sides of the fin body "to maximize the turbulent current mixing effect." In contrast, the fin of claim 50 is arranged with a majority of the tabs provided substantially parallel to expected flow paths to minimize or limit disturbance and/or to avoid creating an undesirable pressure drop. Hence, Yun fails to show the tab structure called for in claim 50 and to show the positioning of such tab structure (e.g., parallel to local flow paths). Gunter fails to overcome the deficiencies of Yun as it is also directed to use of slits on a fin surface. Applicants request that the rejection of claim 50 be withdrawn as failing to teach or suggest the claimed fin.

Claims 51-56 depend from claim 50 and are believed allowable over Yun and Gunter at least for the reasons provided for allowing claim 50 over this reference. Further, claim 52 specifies a number of possible shapes for the tabs, and the Office Action provides no citation to Yun for teaching this group of shapes for the Yun sidewalls 11a, 11b nor for the Yun central portions of slits 11. Claim 53 calls for "a larger percentage of the tab body surface area" to be located proximate to the fin body. The Office Action fails to provide a citation to Yun for this teaching. Based on a review of Yun, if the entire slit 11 is considered the tab of claim 50, Yun fails to suggest the limitation of claim 53 as the central portion is the majority of the surface area and it is distal to the fin body. If just the sidewalls 11a, 11b are considered the tabs, Yun still fails to suggest this limitation as the sidewalls are always shown to simply be rectangular (see Figure 7, for example). For these additional reasons, claims 52 and 53 are not suggested by Yun and Gunter.

Further, the Office Action rejected claim 36 under 35 U.S.C. §103(a) as being unpatentable over Yun or Schulze in view of U.S. Pat. No. 5,682,784 ("Stoynoff"). Claim 36 depends from claim 18 and is believed allowable over Yun and Schulze at least for the reasons provided for allowing claim 18 over these references. Further, Stoynoff is not cited for and fails to overcome the deficiencies of Yun and Schulze discussed above in reference to claim 18.

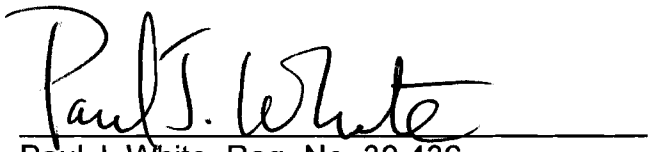
Still further, the Office Action rejected claim 37 under 35 U.S.C. §103(a) as being unpatentable over Yun or Schulze in view of DE 3918610A ("Relfe"). Claim 37 depends from claim 18 and is believed allowable over Yun and Schulze at least for the reasons provided for allowing claim 18 over these references. Further, Relfe is not cited for and fails to overcome the deficiencies of Yun and Schulze discussed above in reference to claim 18.

Conclusions

In view of all of the above, it is requested that a timely Notice of Allowance be issued in this case.

No fee is believed due with this submittal. However, any fee deficiency associated with this submittal may be charged to Deposit Account No. 14-0460.

Respectfully submitted,



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